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PATENT SPECIFICATION

Application Date: Sept. 17, 1921. No. 24,701/21. **194,739**

Complete Accepted: March 19, 1923.

COMPLETE SPECIFICATION.

Vehicle, more particularly a Locomotive, with Combustion Engine and Liquid Driving Gear.

I, HEINRICH SCHNEIDER, of Jllnau, Winterthur, Switzerland, a Swiss citizen, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention has reference to a vehicle drive, more particularly a locomotive drive, with combustion engine and liquid driving gear. It is a well known fact that, in order to overcome the initial difficulties attendant on propelling a vehicle, more particularly on starting a locomotive by means of combustion power, detachable couplings or liquid driving-gears are used.

It has been proposed to provide hydraulic driving gears having rotating primary and secondary parts, but no stationary parts and to provide mechanical transmission means between combustion or other engines and the said primary parts.

Vehicle drives utilizing liquid gears have also already been proposed, in which the driving gears were required to respond to the following conditions: The driving gear, when starting, should exert an increased torque, it should allow changes of speed at a constantly high efficiency and the liquid driving gear should further be reversible. To attain these conditions hydraulic power transmitting apparatus have been proposed consisting of a combination of a liquid driving gear or clutch with planetary gears.

Furthermore liquid driving gears are known which are fitted with non-rotating parts such as guide vanes to provide for the reversing of the gear.

For the propulsion of ships hydraulic clutches incorporated in a toothed gearing have been proposed to provide for the possibility of transmitting the power for cruising speed through the toothed gearing and the hydraulic clutch whilst for full speed the hydraulic clutch is rendered inoperative and *vice-versa*.

For locomotives running at full speed the efficiency of the liquid driving gear is of vital importance.

A vehicle drive, more particularly a locomotive drive in accordance with my invention comprises the combination of a combustion engine with mechanical transmission means and a liquid driving gear having rotating primary and secondary parts but no stationary parts, one of the said parts surrounding the other and being fitted up as a hollow shaft whereby the power input as well as the power output of the said gear occurs on both sides of a plane at right angles to the axis of the gear and passing through the middle of the gear thus permitting the standard two-sided drive of the locomotive or other vehicle.

The primary part of the liquid driving gear may be the part which is fitted up as a hollow shaft, the secondary part being rigidly connected to an axle lodged in the hollow shaft and carrying the driving wheels of the vehicle, or *vice versa* the secondary part may be fitted up as a hollow shaft to which the driving wheels are fixed and an axle connected to the primary part be lodged inside the hollow shaft.

The high efficiency of the liquid driving gear is due to the fact, that only two rotatable and no fixed parts are provided whilst most of the other driving gears possess fixed casings and guiding devices.

In most cases a multiplication of the rotary moment is not needed, since with my liquid driving gear the full moment of full rotation of the driving machine

[*Price* 1/-]

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can be put to use; a reduced efficiency of the device during the short time occupied in starting being immaterial.

When using in a vehicle drive, mechanical transmission means such as toothed wheels, the employment and arrangement of such means is facilitated by the simultaneous use of liquid driving gears, and by employing several of the liquid driving gears, multiplication and reversibility of the drive can be obtained.

My liquid driving gear is more suitable than others for employment with locomotives for the following reasons:

1. The proportions of my liquid driving gear say for a given number of revolutions of the locomotive and machines and for a high degree of efficiency are such as to allow the gear to be built for locomotives.

2. The dimensions of the gear whether partly or entirely filled are such as to always give good starting results.

3. The use of the liquid driving gear imparts a smooth and steady movement to a locomotive and permits the use of a device with toothed wheels for the power-transmission. The smooth and steady movement of course also protects all other parts of the machine from wear.

4. The driving gear when fitted with radial blades works equally well in either direction and can also run idly without being subjected to wear.

5. This driving gear allows of the installation of the heaviest combustion engines running at any number of revolutions.

Since great difficulties arise in building locomotives with regard to the arrangement and the installation of a combustion motor and liquid driving gear on account of the necessary great output, high efficiency, and number of revolutions and the permissible weight, my liquid driving gears, are placed upon the driving shafts, by which arrangement the most favourable running conditions are obtained.

My invention will be best understood, when described in connection with the accompanying drawings in which Figures 1, 2 and 3 represent sections through the driving shaft and liquid driving gear and each illustrate a different constructional example.

According to the first example of construction shown in Figure 1 the motor shaft transmits by means of suitable appliances, for example coupling rods, toothed wheels, and so forth (not shown in the drawing) the power delivered by the motor to the primary axle 1 which is rotatably mounted in the frames R, R^1. On this primary axle 1 are placed the primary parts of the liquid driving gear 2, 2^1. The secondary parts of the driving gear 4, 4^1 are placed on the secondary shafts 3, 3^1, which are hollow and carry the driving wheels 3^{II}, 3^{III}. The secondary shafts are rotatably mounted in bearings in the frames R^{II}, R^{III}. The bearings are supported on springs provided on the frames R^{II}, R^{III}. Moveable stuffing boxes 5 situated between the primary and secondary shafts prevent the liquid from escaping. The gear is filled with liquid through the axle 1 and is emptied through the secondary shaft 3^1 and axle 1, in the same manner as is described with reference to Figure 2.

According to the second example of construction shown in Figure 2 a rotatably mounted shaft 6 transmits the work done by the motor to the liquid driving gear by means of the toothed wheel 7. The secondary part 8, 8^1 of the liquid driving gear is built together with the driving shaft 9, upon which the driving wheels 10, 10^1 are firmly fixed and is enclosed by the two-part primary part 11, 11^1 of the gear. The latter is rotatably mounted in bearings 12, 12^1 which are rigid in the frame 13, 13^1; the part 11^1 has a toothed rim 14 which meshes with the toothed wheel 7 and is driven by the latter. The driving shaft is rotatably mounted in bearings 15, 15^1 which are mounted on springs in the frame 13, 13^1. The liquid driving gear has clearance room on all sides and an arrangement of laterally movable stuffing boxes 16, 16^1 and 17, 17^1 is provided, so that a lateral displacement of the driving shaft is made possible.

The following devices are arranged for the purpose of filling and emptying the driving gear.

Liquid is supplied to the driving shaft 9 through the pipe 18 and the swivel joint 19 and conducted into the hollow boss of the part 8 through the axial bore 20 and radial apertures 21 from whence it enters the working chamber through openings 22. On the periphery of the gear chamber there are arranged several pipes 23 which are fixed preferably at regular intervals over its circumference. These pipes extend into the chamber 24 between the two stuffing boxes 16^1 and 17^1. If the driving gear is full, injected fresh water forces a part of the heated gear water through the pipes 23 the stuffing box chamber 24, the apertures 25 and the axial bore 26 and then through the swivel joint 27 and the pipe 28 into a collecting tank (not shown on the drawing).

The gear is emptied by means of compressed air, when the primary parts are rotating. Like the liquid, the compressed

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air is introduced through pipe 18, enters the working chamber through the apertures 22 and forces the water, which is driven to the periphery by reason of the turning movement, through the pipes 23, the chamber 24 and pipe 28 into the collecting tank.

It will be seen from indications in the drawing that the shaft 6 and wheel 7 are also employed to drive a second liquid driving gear 29 with driving wheels 30, 30¹, which is arranged symmetrically to the liquid driving gear described above.

Figure 3 shows a gear, of which the secondary part is fitted up as a hollow shaft serving as a bearing for the driving shaft upon which the primary part is fixed. The power from the motor (not shown in the drawing) is transmitted by gear wheels 31, 31¹ to the primary part 32, which is fixed to the driving shaft. The secondary part 33, 33¹ forms a hollow shaft and is provided with bearings 34, carrying the driving shaft 1. The secondary part 33, 33¹ carries brackets 35, 35¹ provided with bearings 36, 36¹ serving as outer bearings for the shaft 1. The secondary part 33, 33¹ is carried by the frame R, R¹. The filling and emptying of the gear is brought about in the same manner as described with reference to Figure 2.

In order to prevent any leakage, a stuffing box 37, is provided near each of the frames R and R¹ and is arranged with a chamber 38, to catch any leakage water, which can escape through an opening 39. The shaft 1 is shown provided with a ring 40, which throws off any leakage water, reaching it through the opening 41 of the bracket.

The working chambers, by means of which, at the same time the thrust is neutralised, are so constructed as to enable the gear to be of the smallest possible diameter and simplest possible construction and to utilise to the fullest extent the space between the driving wheels. One of these working chambers in the example given in the drawing consists of two blade wheels. The primary part works as a pump and the secondary part as a turbine. The axial and radial clearances between the two gear shafts can be allowed variations within the limits defined by a lateral displacement and the spring of the secondary shaft, without such variations exercising any perceptible influence on the degree of efficiency obtained.

If several motors working independently of one another are equipped with liquid driving gears, each motor and each gear can be switched on and off separately, so that each motor can work by itself with the gears belonging to it and the other motors can remain stopped with their gears empty.

Moreover, for example, when running down hill, the gear can be used as a brake. In such a case the motor and thereby the primary part of the liquid driving gear may be stopped, whereupon the turning moment imparted to the secondary part of the gear by the vehicle running down hill is transformed into whirls of the liquid projected against the stationary primary part by the rotating secondary part. The rotating secondary part of the gear may further drive an air pump which is operatively connected to the gear and utilized for filling an air tank, thus causing the braking action.

Furthermore the gear permits of reversing the combustion engine while the train is going forwards because the one part of the gear can rotate in opposite direction to the other part thereof.

The gear can also be used for starting only; in this case the liquid driving gear only works at the start, the primary and secondary parts of the gear being coupled together by means of any suitable coupling device, as soon as a certain degree of speed is obtained.

It goes without saying that the parts of the gear can be constructed in any way, together with the driving wheels or the wheel rims.

The method of employing the above described vehicle is the following:

The starting of the motor of, say, an oil-driven engine, takes place when the train is standing still, as in the case of a stationary motor. If the driving gear is empty when the start is made, it must be filled as soon as the motor has reached a certain number of revolutions. The gear can be partially or wholly filled whilst the train is starting. After filling the driving gear the motor is supplied with its largest quantity of fuel. The maximum supply is maintained until normal speed is reached. At intermediate stations the motor can be allowed to continue to run at reduced speed with full or partially full or empty gear while the train is at rest, the small turning moment of the motor running at reduced speed being incapable of causing that part of the gear which is connected to the driving wheels to rotate and start the braked train. Thus the motor does not require to be started afresh on each starting of the engine.

The construction and the running or working of locomotives driven by combustion egnines is rendered extremely simple by an arrangement of liquid

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driving gears as described herein, as the principal motor can serve to fill the compressed air chambers when the train is standing still and the gears are empty, thus avoiding the use of large compressed air chambers and large auxiliary compressors necessary for direct propulsion.

Moreover a greater flexibility of the driving shafts is obtained by simple means whereas hitherto steam and especially electric locomotives, have always had to be equipped with very expensive and very complicated construction.

By means of the above described arrangement of the liquid driving gears the whole of the space above the platform can be kept free for the combustion engine, auxiliary appliances and for the service of the locomotive.

As the primary shafts are firmly embedded, a rigid propulsion system between the motor, frames and primary shafts is obtained and as there is an elastic connection only between the driving wheels and the motor and the frames, the shock coming from wheels is not transmitted to the motor, nor the shock from the motor to the wheels. This is of great importance especially for fast locomotives, it increases the length of life both of the locomotive and its subconstruction and enables trains to be run at a high speed.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a vehicle drive, more particularly a locomotive drive, the combination of a combustion engine with mechanical transmission means and a liquid driving gear having rotating primary and secondary parts but no stationary parts, one of said parts surrounding the other and being fitted up as a hollow shaft whereby the power input as well as the power output of said gear occurs on both sides of a plane at right angles to the axis of the gear and passing through the middle of the gear thus permitting the standard two-sided drive of the locomotive or other vehicle.

2. A vehicle drive according to Claim 1, characterised in that the primary part of the liquid driving gear is fitted up as a hollow shaft and that the secondary part is rigidly connected to an axle lodged inside the hollow shaft and carrying the driving wheels or, *vice versa*, that the secondary part is fitted up as a hollow shaft to which the driving wheels are rigidly fixed and that the primary part is rigidly connected to an axle lodged inside the hollow shaft.

3. A vehicle drive according to Claim 1, characterised in that the combustion engine, the mechanical transmission means and the primary part of the liquid driving gear are fixed on the frame of a locomotive and that the secondary part of the liquid driving gear to which the driving wheels of the locomotive are rigidly fixed, and by which wheels the weight of the locomotive is sustained through the interposition of springs, is rendered movable in all directions by the provision of movable stuffing boxes and of clearance between the operative parts of the gear.

4. A vehicle drive according to Claims 1 and 3, characterised in that at least one pipe is provided leading from the periphery of a chamber of the gear to a chamber of a shaft stuffing box and that the liquid driving gear is emptied by means of compressed air pressing the liquid out of the gear.

5. A vehicle drive according to Claims 1 and 3, characterised in that the liquid driving gear is utilized for braking the vehicle, the braking action being caused by employing one part of the liquid driving gear to drive an air compressor operatively connected to the liquid driving gear and utilized for filling an air tank.

6. A vehicle drive, more particularly a locomotive drive, having in combination a combustion engine, mechanical transmission means and a liquid driving gear substantially as hereinbefore described and as illustrated in the accompanying drawings.

Dated this 16th day of September, 1921.

For the Applicant,
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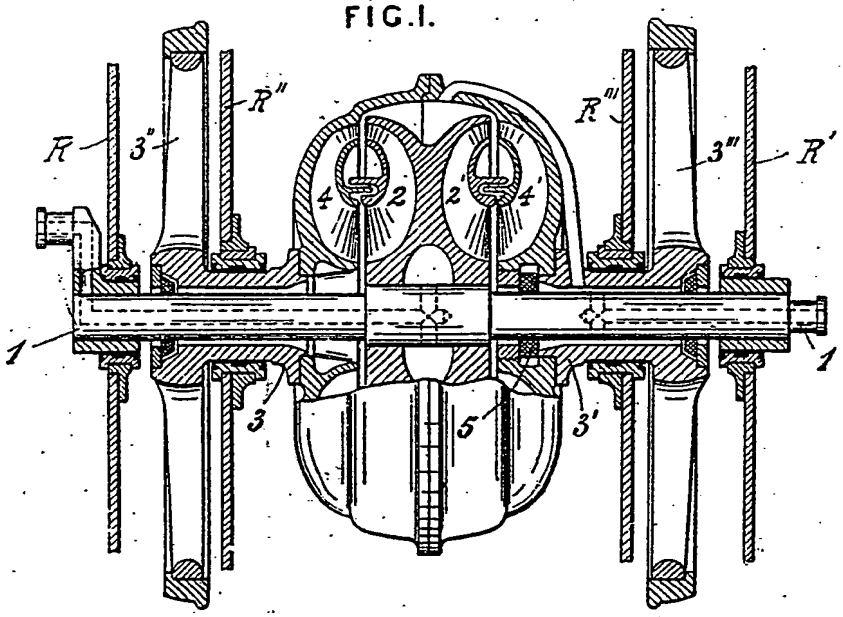
[This Drawing is a reproduction of the Original on a reduced scale.]

SHEET 1

FIG. 1.



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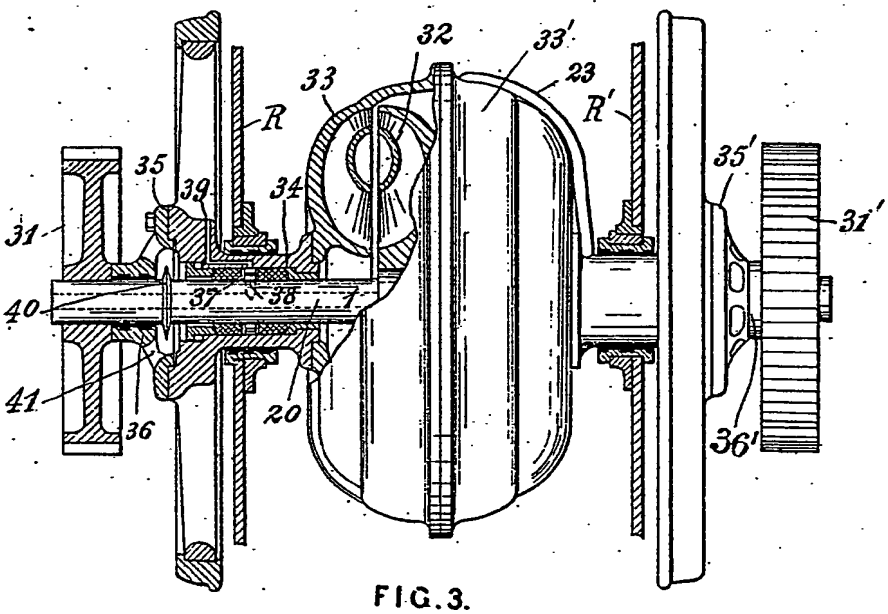

FIG. 3.

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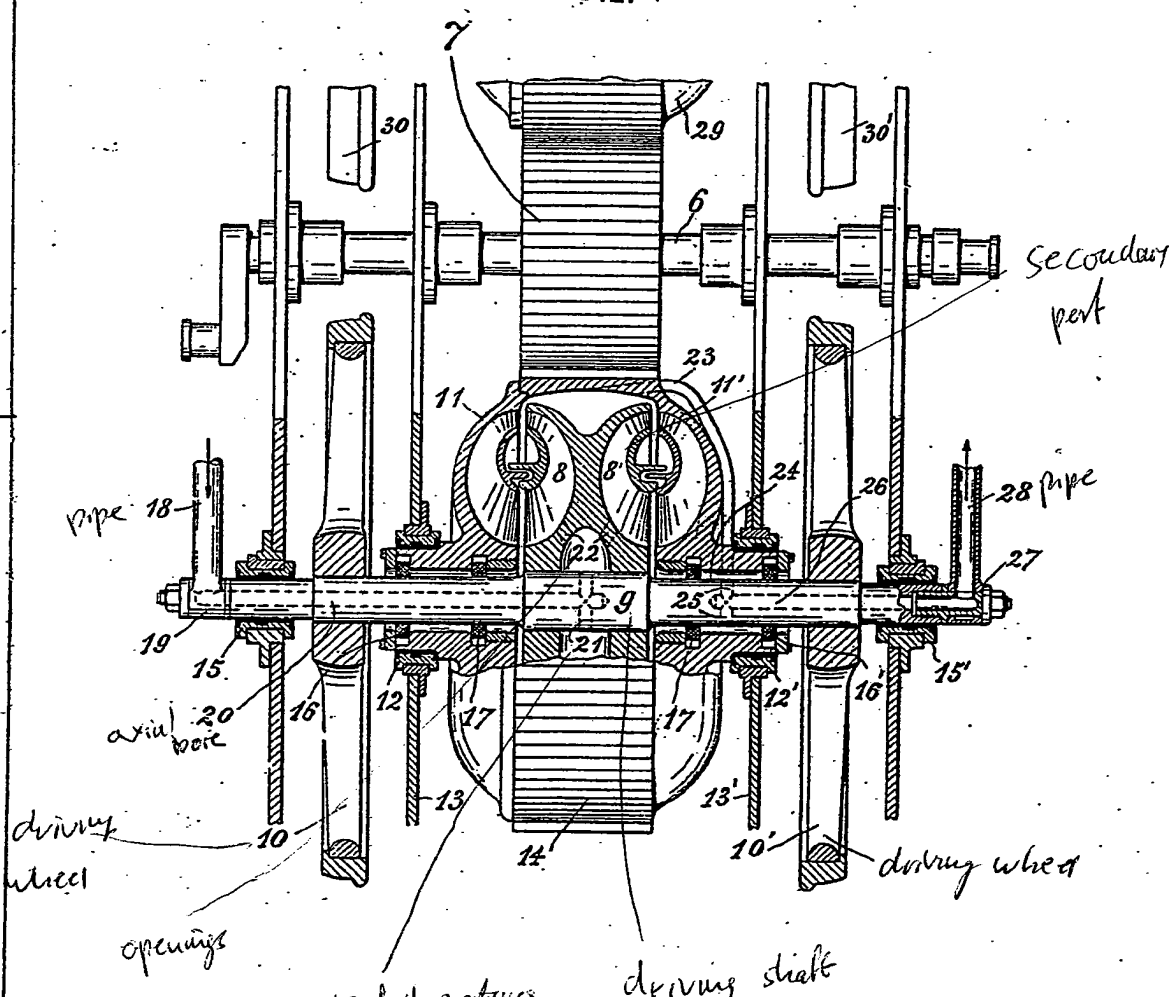
FIG.2.



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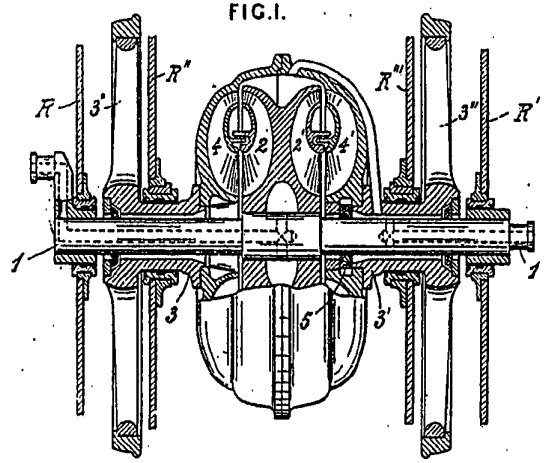
SHEET 1

FIG.1.



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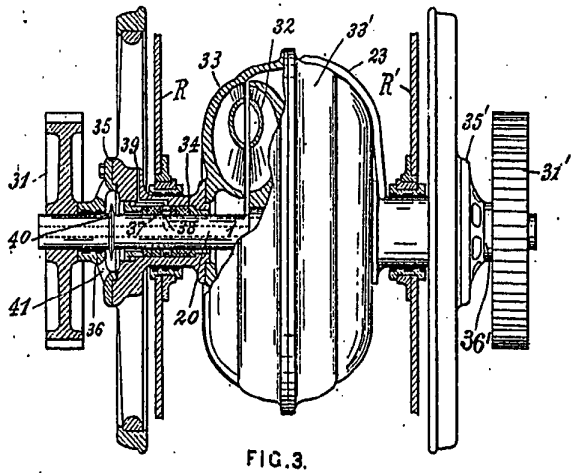
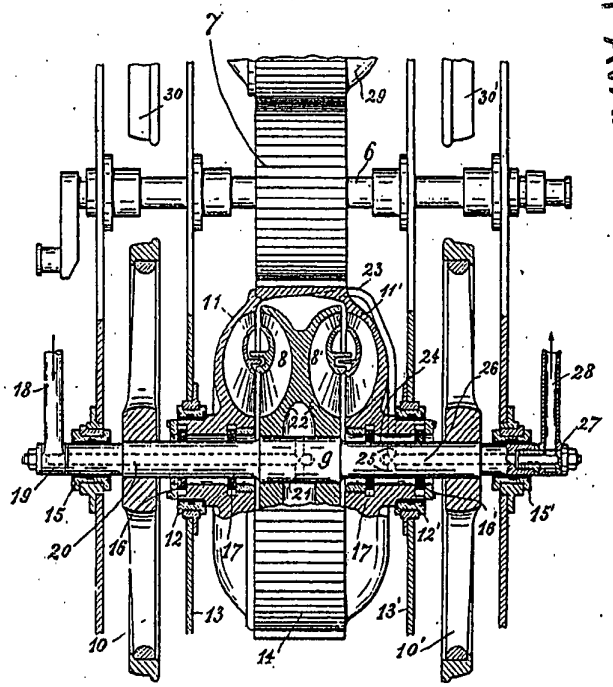


FIG.3.

[This Drawing is a reproduction of the Original on a reduced scale.]

SHEET 2

FIG.2.



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